new technology

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The Research Associations Work with Europe

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Membership of the European Economic Community is going to open up immense opportunities for increasing our sales abroad; and not only sales of equipment and goods: British expertise and knowledge are also marketable commodities. The commonest method of exporting scientific and technological know-how is by licensing, but this, of course, applies only where the commodity for sale is a new process, design or material. Provision of specialist services is a different but, nonetheless important, method of export. Over the years many of Britain's research associations (RAs) have worked with various organisations in Europe (most of them have, for example, long been involved in international work on standards and codes of practice), and to this extent they are virtually already 'in Europe', and are well placed to play their part in developing exports of technological advice and services.

The RAs are non-profit making autonomous bodies, serving, and drawing their membership from, a particular industry or group of industries. Thirty of them receive a grant from the Department of Trade and Industry, four receive a grant from the Department of the Environment and four from the Ministry of Agriculture, Fisheries and Food; and all of them are encouraged to enrol overseas members, provided a satisfactory subscription can be agreed. The attitude of the Council of a given RA towards recruitment of European members and co-operation with European research institutes naturally depends to some extent on the degree of international competition and the relative strengths of the industries in Britain and in the other nine member or potential-member countries of the EEC. However, those RAs grant-aided by DTI—and the British Non-Ferrous Metals Research Association, the Paint Research Association, the Rubber and Plastics Research Association of Great Britain, the Shoe and Allied Trades Research Association and the Welding Institute are well to the forefront here—are already getting, in all, about £200,000 in annual subscriptions from these nine countries. Some of the RAs are also paid considerable sums in support of particular projects and as fees for contract work and for services.

The research associations' contacts with Europe fall reasonably happily into four broad classifications: (1) relationships with European firms; (2) collaboration with European counterparts; (3) co-operation with European international organisations; and (4) ways in which the RAs are publicising their specialist services and know-how on the Continent and preparing their members for British entry. Examples of these four types of activity are given in this article, but it is emphasised that the list is by no means exhaustive and that most of the examples cited could be matched several times over by further cases from the RAs mentioned and from RAs covering other fields.

The British Non-Ferrous Metals Research Association's mobile computer visits a firm in Issoire, France.

The RAs and European firms

Breaking new ground, the Non-Ferrous Metals RA recently sent a team with a mobile computer to Cegedur GP's aluminium-melting plant in Issoire, France, to demonstrate how furnace performance can be substantially improved by greater application of models derived from direct practical observations.

Another case of co-operation in improving furnace performance is the pioneer international inter-firm comparison study in the glass industry undertaken by the British Glass Industry Research Association, in which more than three-quarters of the glass-container industry in the United Kingdom, Western Europe and the United States participated. A new statistical technique was developed, and the savings amount, in this country alone, to at least £300,000 per annum.

Working together, Lambeg Industrial Research Association (LIRA) and the Koninklijke Shell Plastics Laboratories, Delft, have produced, and jointly patented, an improved type of fibrillator, Shell supplying much of the know-how on polymers and extrusion techniques and LIRA the necessary textile technology.

Other RAs are conducting confidential sponsored projects for foreign firms.

Co-operation with European counterparts

The RAs are well placed to take on sponsored work for Continental institutes, but to date contact has been based predominantly on technical co-operation. Some examples:

★ International co-operation in printing research is well developed. The International Association of Research In-

(continued on next page)

stitutes for the Graphic Arts Industry (IARIGAI), formed largely on the initiative of the British RA, PIRA—The Research Association for the Paper and Board, Printing and Packaging Industries—which provides the Secretariat, has 31 members in 17 countries. Within IARIGAI, graphic-arts research institutes are closely knit, and the facilities for co-operation between member institutes (for example, a research conference is held every second year, and workers from member institutes meet at symposia to discuss particular subjects) are now being extended to member firms of the IARIGAI institutes. In a germane field, an international conference has just been held in London under the auspices of PIRA and IAPRI (The International Association of Packaging Research Institutes), an association similar to IARIGAI and which has also depended on PIRA for secretarial services.

★ International co-operation in laundering and dry-cleaning research is also extensive. The British Launderers Research Association played a leading part in setting up the International Scientific and Technical Committee on Laundering, at whose annual meetings (the 21st was held last year) representatives of the RA and of the research institutes of eight other West European countries discuss a range of subjects, including research programmes, areas for co-operation, standardisation of test methods and the probems of care labelling.

★ Several RAs—including the Glass RA, which has links with the other five Western European counterpart institutes—exchange research programmes with European research institutes. The British Ship Research Association and the research institutes in Belgium, Denmark, France, Holland, Italy, Norway, Spain, Sweden and West Germany exchange information about their research programmes and some research reports.

★ Conjointly with the Dutch Paint Research Institute (which is one of the institutes associated with the TNO—the Organisation for Applied Scientific Research in Holland), the Paint RA has been studying the rheology and the application properties of paint. It is also collaborating with the Dutch Institute in weathering tests in which paint systems are being exposed at six sites provided by research institutes in various countries on the Continent, two sites in Australia, one in Florida and two in the United Kingdom.

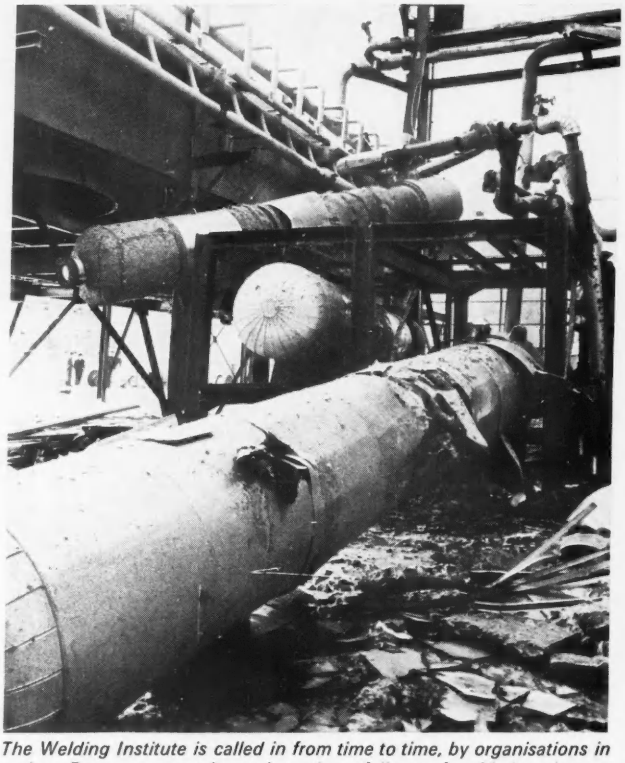
★ The Lambeg Industrial Research Association maintains long-standing contacts with the various Continental research institutes working on flax, and, in 1971, co-founded, with three of these institutes, a Research Fellowship for morphological study of flax at the New University of Ulster.

★ The Shoe and Allied Trades Research Association (SATRA) is co-operating with the leather and shoe research institutes of the EEC in preparing abstracts of literature on the footwear and leather industries and on management topics. SATRA has a particularly close relationship with the TNO-associated Dutch Footwear Research Institute (for example, members of the Institute are members of SATRA through a block subscription), and SATRA makes a contribution to the Institute in return for technical know-how and information. The two laboratories have collaborated in work on the halogenation of soling, and TNO has modified the *Satreat* process to produce *Tonosol*, and has agreed to pay SATRA part royalties on the product.

★ The Rubber and Plastics RA has developed links with the French Laboratoire de Recherches et de Contrôle du Caoutchouc, and the Laboratoire has organised the sale throughout France of RAPRA's data sheets on the chemical resistance of rubber and plastics.

Co-operation with European international organisations

Some of the RAs' international work on standards is done through European-wide organisations.



The Welding Institute is called in from time to time, by organisations in various European countries, to investigate failures of welded equipment and plant. One such failure is shown above.

The Motor Industry Research Association (MIRA) provides an industrial adviser to the Economic Commission for Europe committee members on the formulation of European standards for control of air pollution caused by road vehicles, and is also working for the Department of the Environment and the British Technical Council of the Motor and Petroleum Industry on the development of methods of measuring diesel-engine smoke and petrol-engine emission suitable for incorporation in European standards. The Electrical Research Association is well represented on various organisations concerned with the development of European standards on industrial and domestic electrical equipment (for example, it has taken a leading part in the work of the Conférence Internationale des Grands Réseaux Electriques for no less than fifty years), and WIRA (formerly the Wool Industries Research Association) is actively engaged in establishing standards and specifications in conjunction with all the European members of the International Wool Textile Organisation. SATRA has played no small rôle on the joint European Free Trade Area/EEC Committee studying millimetre size-markings for shoes, and a draft International Standards Organisation standard is now being circulated. British exporters are selling shoes on the basis of quality and fit, and hope to benefit from a more rational sizing system.

The RAs are also, of course, involved with European organisations in fields other than standards. The Assistant Director of MIRA is, for instance, the British motor industry's representative on the fuels committee of the co-ordinating European Council for the performance testing of lubricants and fuels. SIRA Institute's Instrument Evaluation Panel exchanges all reports with the Dutch-based Working Party on Instrument Behaviour, which has some 18 members, including German, French, Dutch and Norwegian companies. The British Ceramic Research Association is co-operating in a project initiated by the Commission Européennes de Carreaux (the European Tile Association) with the aim of developing methods of testing frost-resistance in tiles; it is heavily engaged in the technical activities of the European Federation of

SIRA Institute's lens-centring gauge, orders for which have included some from Europe and the Far East. The gauge, a versatile photo-electric centring aid, is used in the 'exchange-spindle' method of lens centring and edging.

Refractories Manufacturers, particularly in the development of standard methods of test for refractory materials; it is a member of the Heads of Laboratories Working Party of the Fédération Européenne des Fabricants de Tuiles et de Briques, which is analysing various European and other codes relating to load-bearing brickwork with the aim of adopting the best features of each, and so optimising the use of such brickwork; and it exchanges information on the effect of gas explosions with European institutes. The Electrical Research Association has a contract from the European Space Research Organisation for the development of protective coatings on solar cells for powering satellites. The Directors of WIRA and the Cotton, Silk and Man-made Fibres Research Association are the UK representatives on the Groupe Européen d'Echange d'Expériences sur la Direction de la Recherche Textile, which has organised some inter-laboratory work. And, one final example, the Textile Research Conference, of which all the Textile RAs are members, expects soon to be accepted as an observer on the scientific and technological research committee of Comitextil, the Committee which co-ordinates the activities of the textile industries in the EEC.

Other links with Europe

Many of the RAs are now working hard to sell their services in Europe. One way of publicising what they have to sell is to exhibit at international conferences; and this is what the Cotton, Silk and Man-made Fibres, Hosiery, Lambeg and Wool RAs did at the International Textile Machinery Association's exhibition in Paris in 1971, and SIRA Institute at Interkama (the international instrument exhibition) in the same year. Another way is to hold international conferences in major European industrial centres. Here one could cite in example: The British Non-Ferrous Metals Research Association, which has held international conferences in Düsseldorf, Basle and Liège; the British Hydromechanics Research Association, whose conferences on fluidics and fluid sealing are well established (future conferences include one on fluidics at Uppsala University in June 1972, one on fluid-sealing in Munich in February/March 1973, and a fluid-power symposium to be held in Turin in May 1973 in conjunction with the ITM Polytechnic); the Rubber and Plastics RA, which has held regional meetings in Denmark, Sweden and West Germany (the last in Kronberg in November 1971); the Welding Institute, which arranged a joint meeting with its German counterpart in London early in 1971, to which many European and other overseas countries sent delegates; SIRA Institute, which organised the technical programme of the international electro-optic systems design conferences held in Brighton in 1971 and 1972; and the Electrical RA, which initiated the formation of a new international conference on the distribution of electricity in towns and factories (meeting alternately in London and Brussels), and which is also establishing agencies in European countries.

Several RAs (eg, the Furniture Industry Research Association) organise European study tours for their members and/or visits to the UK by potential members from the Continent. The Spring Research Association, which is unique in Europe, is inviting all the major European spring manufacturers to visit its new building at Sheffield, to see the facilities, talk to the staff and assess the benefits of membership.

The Production Engineering Research Association, which has long provided intensive refresher courses in French, German and Spanish, is now arranging technical English courses for European executives and engineers. It is also helping to prepare its members for British entry by running conferences on such aspects as 'Into Europe—selling the technical product'.

The future

An RA's links with Europe have to be forged on a personal basis, just as those between the RA and its British members. Its staff will have to get to know those of European companies and of the European research institutes, and, when planning its programme, an RA will have to take account of the needs of its foreign members; and this two-way collaboration should stimulate the RA to enter new fields, to the benefit of its British members. Building bridges is not a task which can be hurried, though the few examples given in this short article should show that the RAs have the task well in hand, and are determined to play a significant role in the development of future European technology. Under the aegis of the Conference of Industrial Research Associations, an eminent panel is reviewing the place of the Research Associations in modern industrial life, including their rôle in Europe after the UK joins the European Economic Community. This review will no doubt help to point the way ahead.

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Computer-Controlled Data Preparation: It Could Save You Money

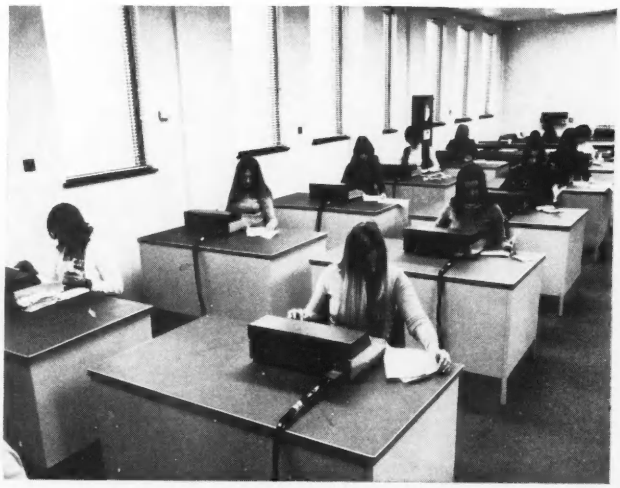
by B. M. Smart,
Computers Systems and Electronics Division, DTI

Present keyboard systems

DATA can be fed into a computer only in a form acceptable to the computer. Using a keyboard terminal, the data can be prepared for entry in three basic ways. The keyboard is, of course, merely the means of operating the equipment which transcribes the information from the handwritten, typed or printed text into computer-readable form, and it is the transcription itself which concerns us. The transcription, then, can be achieved (1) by means of an appropriate pattern of holes punched in a card (the oldest and most widely used form of computer input), (2) by means of an appropriate pattern of perforations in a paper tape, or (3) by means of a pattern of minute magnetised areas on a tape similar to that used on a domestic tape recorder (magnetic-tape input can be read much faster than data input via punched cards or perforated tape). But what if the operator miskeys a character, and so produces incorrect data for entry into the computer? To prevent such aberrations, use is made of the control called *verification*—the process by which keyed data is checked automatically by comparing it with data keyed from the same source documents by the same or a second operator.

From the point of view of verification, all three conventional data-processing systems have drawbacks. Take the punched-card system. Initially the only verification possible at the input stage was for an operator completely to rekey the data (once a card is punched, it cannot be used again), but the introduction of buffered card punches has now greatly improved matters by eliminating the need for complete rekeying. The buffered punch incorporates a small store in which the keyed data is retained until sufficient information has accumulated for production of one complete card, at which stage, unless the operator intervenes, punching starts. The operator can intervene at any time to correct conscious errors by back-spacing and re-entering the data before the card is punched. Verification via punched cards nevertheless remains a time-consuming, and hence costly, task. The perforated-tape system suffers from the same basic verification limitations as the punched-card, and, though errors on tape can be corrected more cheaply than on a card, some thought is being given to the possibility of introducing buffering here too. The magnetic-tape system also depends upon buffering for its verification procedure.

The Rank ENM Enscriber, shown above, is a desk-top magnetic-tape data-preparation unit which offers the organisation with wide-spread business locations a means of submitting data swiftly to the central computer. It is simple to operate, can be used at any location and incorporates programming facilities enabling the data to be validated automatically on input: all of which means that data can be prepared at source by the staff mainly concerned (so minimising the risk of transcription errors), and, since the system is one-pass (error detection being built in), verification is not required.

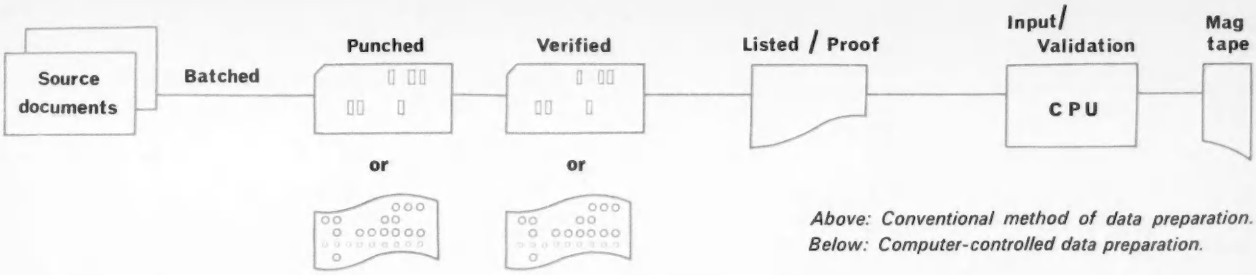


A typical computer-controlled data-preparation system. (Photo: Redifon Ltd, Data Systems Division.)

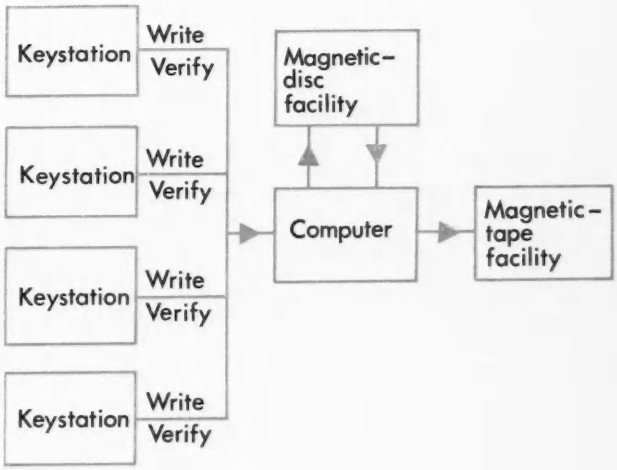
Computer control

Obviously therefore none of the three conventional systems is ideal. But how to improve on them? In the computer field, computerisation tends to spring to mind as the first answer to any problem ... but in this case it has proved an effective answer. In computer-controlled data preparation a small subsidiary computer is used to carry out some of the checking processes previously undertaken by the keyboard operator. The computer is programmed to ensure that each item of data is consistent with other items of data to be entered into the main computer, and in this way it can simultaneously *validate* all the data input from as many as 30 key-stations.

The equipment used with computer-controlled data preparation is also itself a source of increased efficiency: for example, the keyboards will accept a faster rate of key depression than most card punches, and conscious errors can be corrected more easily and rapidly. Different degrees of sophistication are possible even with this type of system, and a decision on the particular form of equipment to use will depend on the requirements of the application and the money available. But, if maximum use can be made of the highly sophisticated validation and editing facilities available from the more advanced systems, the savings ensuing from computer control will obviously be all the greater. For instance, many existing data-preparation units relying on conventional equipment, and hence burdened with as much as 100 per cent verification, could have their verification requirements halved, with no sacrifice in accuracy, by adoption of computer control. In short, the new technique holds out prospects of greatly reducing data-preparation costs: hence the great emphasis placed on its value in a recent report on the future of computer data preparation in Government installations.



Above: Conventional method of data preparation.
Below: Computer-controlled data preparation.



Potential savings

Overall financial savings will depend on the long-term average throughput achieved, but there is no doubt that labour costs can be substantially reduced. With computer-controlled data preparation the Government sector's present force of 3,500 keyboard operators is expected to be able to cope with any increase in data-preparation work up to at least 1975; without computer control the number of operators will have increased to some 5,500 by 1975. According to the Department of Employment there are about 50,000 keyboards (all systems) in use in Great Britain, excluding the Government sector. Like the Government computer installations, therefore, those in commerce and industry are likely, under the stimulus of the potential savings, to make rapid changes towards the new equipment. Proportionately, the savings may be rather less than in the Government sector, since installations tend to be smaller, but, according to the Department of Employment, staff savings are likely to be as follows (taking the population of data-preparation operators on 1.1.1969 to be 34,000):

Date	*Number of operators required if only conventional equipment were in use*	*Number of operators required as computer-controlled equipment is introduced*
1.1.72	55,000	54,000
1.1.74	70,000	57,000
1.1.79	90,000	70,000

These figures are included in the revised version of the Department of Employment's *Computers in Offices*, due to be published in mid-1972. On a cost basis of £1,200 per operator per annum, the financial savings by 1974 could be around £15 million per annum, and by 1979 around £24 million per annum, at current rates.

The actual savings obtainable will depend, of course, on the size of the installation. If your system includes at least eight key-stations, however, and you are now using card punches, the economic benefits should be considerable. And the cost per unit of throughput will continue to decrease up to the maximum number of key-stations (usually about 30) which can be connected to the particular small computer: if more than the recommended number of key-stations are connected, the rate of keying will be reduced, so nullifying one of the advantages of computer control.

A few cautionary words. New systems bring new problems, and computer-controlled data preparation is no exception. The breakdown of a single punch or verifier is likely to have little effect on the efficiency of the data-processing organisation as a whole; in contrast, failure of the central processor in a computer-controlled system could have very serious repercussions. Up-time has, however, already been increased to better than 98 per cent, and, in any case, suitable stand-by arrangements can be made. Any manufacturer will guarantee to provide assistance within an hour of trouble being reported by the user organisation, and the fault can generally be remedied merely by replacing a small component. If you are a large user, you can shorten down-time even further by duplexing your data-preparation systems so that fewer than the maximum number of key-stations are linked to each processor, so enabling key-stations put out of action by the failure of one processor to be immediately linked with another.

On-line systems

The points made so far have related primarily to off-line data systems. On-line systems do not require a small computer for data-preparation control, since this task is undertaken by the central processor of the same large computer which does the actual computing. The powerful editing and checking facilities available from such on-line systems would probably suit the type of organisation whose input documents are received in batches and have to be processed rapidly—eg, a mail-order firm which dispatches orders on the same day as they are received. The need for verification can be reduced considerably even with such very large and busy systems, provided, of course, that the software includes validation programs.

Future prospects

The changeover to computer-controlled data-preparation systems will bring with it a new attitude towards the problem of verification. After all, a development which brings the day nearer when an operator can put the data in once only, and then leave the rest of the work to the machine, is a money saver. If conventional methods of data preparation continue to be used to the same extent as at present, it is estimated that by 1975 keyboard operators alone will be costing the country more than £100 million per annum. Computer control, with its potential for increasing data-preparation efficiency, and for reducing or even eliminating the need for verification, provides a means of saving a significant proportion of this vast sum.

More information: Mr. B. M. Smart, Department of Trade and Industry, Computers Systems and Electronics Division, Dean Bradley House, Horseferry Road, London SW1. Tel: 01-799 5688, Ext 316.

Hybrid Simulation at Warren Spring Laboratory

Many industrial automation programmes entail, at some stage, an investigation of the behaviour of an item of equipment or even of a complete process plant: the performance of the system may, for example, need to be determined under specific conditions (as in the case of a safety assessment) or the aim may be solely to improve performance. Frequently, trials cannot be carried out on the system itself because they might endanger operational safety or efficiency or prove excessively time-consuming and costly, and here the only recourse is to a 'simulation' study in which the trials are performed upon a 'model' of the system. The practical problems which might arise from the introduction of a new process or product are usually investigated on pilot-scale plants or prototypes, and, in a general sense, this type of investigation could be regarded as a simulation study in which the model is identical in form to the real system. Normally, however, simulation implies the use of a *mathematical* model of the system. Such a model is created by deriving mathematical relationships to describe the physical phenomena involved, and hence consists of a set of algebraic and differential equations relating such system variables as temperatures, pressures, flow rates and compositions. These relationships are often so complex that they can be solved only by means of a computer.

One of the R & D activities in which DTI's Warren Spring Laboratory has considerable expertise and experience is automation in the process industries, and this work is backed up by a major facility—the Laboratory's hybrid-computer installation. This article discusses the relative merits of digital and hybrid simulation in the process field, and outlines the types of problem to which hybrid techniques can be applied with greatest benefit. Detailed information on WSL's work in this field, and on the simulation services which the Laboratory offers to industry, can be obtained from J. Davies, Warren Spring Laboratory, Gunnels Wood Road, Stevenage, Herts SG1 2BX (Tel: Stevenage 3388).

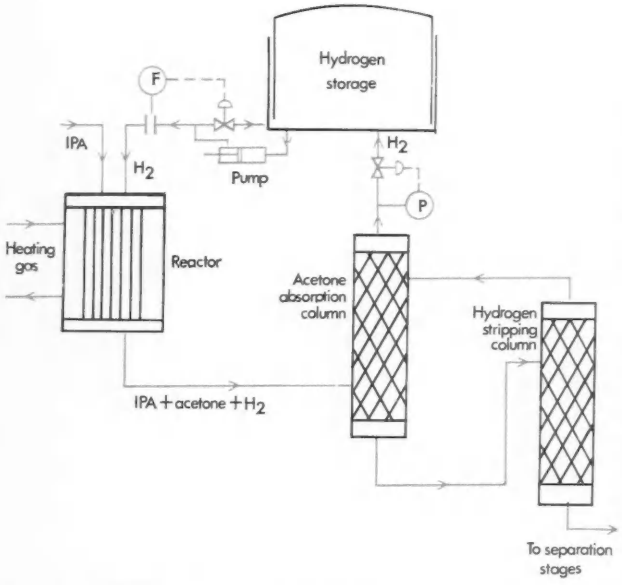


Figure 1. The acetone-plant hydrogen-pressure and -flow loops for which WSL was asked to design a control system.

Simulation

Simulation activities can be divided into two categories:

Qualitative or predictive simulation. Here the model is used simply to predict the behaviour of the system under a given set of conditions: eg, to verify that the performance of the process is satisfactory while the plant is still at the design stage, or to check its behaviour under abnormal operating or fault conditions. Such tests require comparatively few simulation runs, organised so that the results from one model run can be assessed before new ones are initiated.

Quantitative simulation or optimisation. This type of simulation is undertaken as part of a sustained system study aimed at improving performance rather than simply predicting behaviour. Typical examples: establishing the best steady-state operating conditions ensuring minimum production costs for a given throughput, or designing the control features necessary to maintain these operating conditions in the presence of disturbances to the system. In contrast to performance-prediction work, optimisation trials require a large number of simulation runs, which have to be organised by computer program rather than by the user, and the results of the entire trial are analysed rather than those of each simulation run.

Digital vs hybrid simulation

Many digital simulation languages are now available (perhaps the most popular and most powerful are SL1 and CSMP), and all are quick and easy to program, even by people who have had little or no direct experience in the use of digital computers. With digital simulation, however, interactions occurring simultaneously in the real system have to be computed serially, and digital methods are slow, and the cost of each solution is high.

The analogue computer better represents the behaviour of real systems, since the algebraic and differential equations which comprise the mathematical model can be solved simultaneously, using hardware integrations. Hybrid simulation is hence very fast (the time per solution is only about one-thousandth of that taken by digital techniques), and the cost per solution is very small. On the other hand, programming a hybrid computer is a time-consuming task, which can be undertaken only by skilled personnel.

It follows therefore that digital and hybrid techniques have quite separate roles to play in simulation. Digital methods are often more appropriate for qualitative simulation since the ease with which the models can be developed and modified may outweigh the higher cost of the actual simulation runs. Hybrid techniques are suitable for applications (eg, optimisation exercises) requiring very large numbers of model runs—ie, those in which the low cost of solving each run outweighs the expense of programming the experiment.

It is interesting to observe how the roles of digital and analogue simulation have been reversed by recent technological developments. The analogue computer was traditionally used in an interactive manner, with the user able to vary parameters at will, and hence able to acquire a much sought after 'feel' for the problem. Nowadays this role has been taken over by the digital simulation language, which can be run in a 'hands-on' manner via a terminal to a multi-access computer system. Owing to the higher program-preparation costs, hybrid-simulation runs have to be made in accordance with well planned trials, which afford little scope for interaction, but which provide the only means of realising the full computing ability of the hybrid installation.

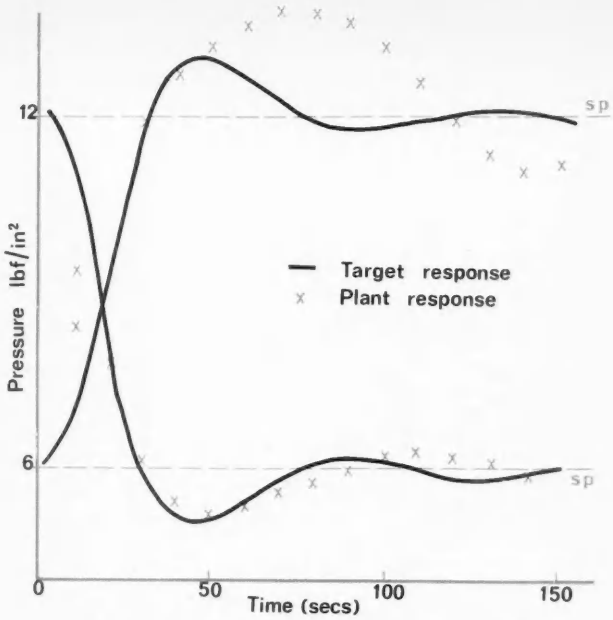


Figure 2. Response to set-point changes in hydrogen pressure.

A case study

The type of problem to which hybrid-simulation methods are being applied is illustrated in Figure 1. The WSL team were asked to design a control system for the hydrogen-pressure and -flow loops in a pilot-scale acetone plant. From the storage vessel the hydrogen is pumped through the reactor system (where it prevents degeneration of the catalyst), then through the absorption and stripping columns (where it is separated from the reaction products) and thence back to the storage vessel. The hydrogen flow is controlled by means of the bypass valve on the pump, and the pressure in the reactor system and the two columns is governed by the valve at the head of the acetone absorption column. The two control loops are highly interactive, and the pressure and flow responses have widely differing time constants—two factors which make the theoretical design of the control system highly complex.

The aim of the hybrid computer trial was to design optimal controllers, which would not only give a good response to set-point changes, but also minimise the disturbances which the changes cause to the second loop. The desired form of the controller step responses was specified by a second-order differential equation whose characteristics could be stipulated by the user. The chosen cost function took account both of the error between the desired and the actual step response and the disturbance caused to the other loop, and was evaluated for both control loops. The optimisation algorithm used was a standard Simplex hill-climbing procedure. The linear structure assumed for the plant model was derived by approximating a linear model to responses obtained experimentally from the plant—an approach which imposed no restriction on the hybrid computer, into which linear and non-linear functions can be programmed with equal facility.

Results for the pressure loop are plotted in Figure 2. Agreement between the desired and actual response forms is good for downward-going step changes in pressure, but not so good for upward-going step changes (a result due entirely to the linear assumptions made about the plant model). Responses in both directions are, however, well damped for both the pressure and the flow loop, and interaction is negligible.

WSL's hybrid-simulation service

In a process-plant study, application of simulation techniques can often result in significant improvements in plant performance. In the case of a large-scale process, even a small increase in efficiency will bring about worthwhile savings in production costs, and for this type of simulation study—in which considerable numbers of model iterations are required to establish optimum conditions—hybrid computation becomes a very attractive method to apply; indeed, for very complex simulation studies, hybrid techniques may be the only ones feasible to use, since digital simulation would prove exceedingly expensive.

Warren Spring Laboratory operates a large hybrid system especially to investigate process-control problems, and has acquired a great deal of expertise in this field. The Laboratory's Hybrid Computing Group is hence able to offer industry a complete simulation service, and its members would welcome any opportunity to discuss the application of simulation techniques to specific problems. WSL is also ready to provide an introductory course on hybrid computation—basically non-technical in nature, and placing emphasis on the philosophy underlying hybrid simulation and on the general problem areas where hybrid-simulation techniques can be used to advantage.

news

IAEA international meetings this year

DETAILS of the following meetings are now available from the Department of Trade and Industry:

Symposium on irradiation facilities for research reactors, November 6-10, Tehran. The object of this meeting is to review the recent advances in the design, construction and proof-testing of irradiation rigs that are appropriate for use in research reactors at the smaller research centres.

The topics to be covered are: Modifiers of radiation fields and beams; Apparatus for sample irradiation; Irradiation facilities, specialised for basic or applied studies; and Measured characteristics of and experience with irradiation facilities.

Symposium on the management of radioactive wastes from fuel reprocessing, November 27-December 1, Paris. The symposium will be limited to the presentation of new data and information directly related to the management of radioactive wastes from reprocessing plants. The topics to be covered are: Sources of radioactive wastes in fuel reprocessing; Waste production and management in the light of new developments in the reprocessing technology; Routine releases from reprocessing plants; Storage of fission-product solutions; Solidification processes for fission-product solutions; Ultimate storage or disposal (including transport); Decommissioning of waste storage facilities and reprocessing plants; and Economical aspects of waste management.

Symposium on radiation preservation of food, November 13-17, Bombay. This symposium will cover recent advances in all aspects of food irradiation, and it is intended to present an up-to-date picture about the present state of activities and the prospects in all branches of the utilisation of atomic energy to increase, preserve and improve man's food supplies. The topics to be covered are: Radiation sources and dosimetry; Chemical and physical effects of radiation on food; Wholesomeness of irradiated food; Physiological effects of radiation on foods of plant and animal origin; Status of radiation preservation of various commodities; Facilities and economics of food irradiation; and Legislation, control and clearances of irradiated food.

For these symposia only nominations submitted through the Department of Trade and Industry will be accepted by the IAEA. Further information: Mr. T. Abbott, Department of Trade and Industry, Millbank Tower, Millbank, London SW1P 4QU (Tel: 01-834 2255, ext. 280).

Conference on industrial innovation

The present state of, and future prospects for, industrial innovation in the United Kingdom will be discussed at a two-day conference organised by the *Financial Times* at the Royal Lancaster Hotel, London, on June 6 and 7. Speakers will include Dr. I. Maddock, Chief Scientist at the Department of Trade and Industry, on 'The role of Government-sponsored institutions and laboratories in industrial innovation'; Dr. L. Rotherham, Vice-Chancellor of the University of Bath, on 'The universities as sources of industrial innovation'; Dr. D. G. Jones, Director of ICI Corporate Laboratory, on 'Large companies as sources of innovation'; Mr. W. Markinson, Board Member and Chief Executive, Department of Engineering, of the National Research Development Corporation, on 'The anatomy of success—some project case

histories'; Mr. L. C. Mather, Vice-Chairman of the Midland Bank, on 'Clearing banks and industrial innovation'; Mr. Jean Guéroult, Administrateur Délégué Directeur Général of the European Enterprises Development Company (EED) SA, on 'Venture capital in its international context'; Mr. Christopher Lanyton, Chef de Cabinet to Mr. Spirelli, Commissioner for Industry, Science and Technology at the European Communities, on 'A European policy for industrial innovation'; and Mr. M. W. Innes, Controller, Finance, of the National Research Development Corporation, on 'Financial assistance for industry's development projects'. The Chairman will be Dr. Basil Bard, Managing Director of the National Research Development Corporation. Delegate forms are available from the *Financial Times* Conference Department, 388 Strand, London WC2R 0LT (Tel: 01-836 5444).

One-day seminar on high-speed grinding

To give users of machine tools and representatives of the machine-tool industry an opportunity of evaluating the potential of high-speed grinding, a one-day seminar has been arranged by MTIRA, in association with the Department of Trade and Industry. It will be held at MTIRA, Macclesfield, on May 17, 1972, and papers will be presented on: (1) applications of high-speed grinding, from the practical experiences of a member of a firm engaged upon the development of high-speed grinding machines; (2) development of vitrified grinding wheels for high-speed use, by a member of a firm engaged in the production of high-speed grinding wheels; and (3) supply of grinding fluid to the high-speed grinding region, giving some of the results of work being carried out at MTIRA on behalf of DTI. A demonstration of high-speed grinding will be given and the seminar will conclude with a full discussion of all aspects of high-speed grinding. More information: Dr. G. Sweeney, Machine Tool Industry Research Association, Hulley Road, Macclesfield, Cheshire SK10 2NE (Tel: Macclesfield 25421 and 26189).

NCC conferences

The National Computing Centre is holding the following conferences in May:

'Operational control and cost recovery in the computer department'; Unicorn Hotel, Bristol, May 9, 1972.

'Use of time sharing fast response systems'; Grand Hotel, Manchester, May 18, 1972.

More information: Peter Wheeler, Public Relations Officer, NCC, Quay House, Quay Street, Manchester M3 3HU (Tel: 061-832 9731).

BSI Technical Digests for exporters

SEVERAL new Technical Digests have been published recently by the THE—Technical Help to Exporters—service of the British Standards Institution. References are listed below.

Electrical equipment for Mexico and Pennsylvania

Technical Digest No. 35 ABC, series 2, issue 1 'Digest of technical information for manufacturers exporting electrical equipment for use in domestic, commercial and industrial situations and in flammable atmospheres to Mexico' is the latest of over 70 Technical Digests dealing with electrical goods, and, like the others, it provides details of the specifications, codes and technical requirements that affect exports to the country concerned, in this case Mexico. Technical Digest No. 104ABC, series 2, issue 1 'Digest of technical information for manufacturers exporting electrical equipment for use in domestic, commercial and industrial situations and in flammable atmospheres to the State of Pennsylvania, USA' gives similar information for Pennsylvania.

Building materials for Denmark, Italy and Belgium

Technical Digests covering the building-construction requirements of particular countries are normally issued in two complementary volumes: Volume A, which gives details of building control regulations, regulative authorities, design procedures and approval systems; and Volume B, which provides reference to specifications and codes applicable to materials, components and building construction. Exporting companies in the building industry are likely to be interested in five new Digests from THE:

No. 2508A, series 1, issue 1 'Digest of technical information for exporters of buildings, building materials and components to Italy'.

No. 2508B, series 1, issue 1 'List of specifications and codes for exporters of buildings, building materials and components to Italy'.

No. 2505A, series 1, issue 1 'Digest of technical information for exporters of buildings, building materials and components to Denmark' (Digest No. 2505B has already been published).

No. 2507A, series 1, issue 2 'Digest of technical information for exporters of buildings, building materials and components to Belgium'.

No. 2507B, series 1, issue 1 'List of specifications and codes for exporters of buildings, building materials and components to Belgium'.

Other building Digests are available dealing with the Republic of Ireland, the Netherlands, Sweden and West Germany.

Gas equipment for Canada

The 'Digest of technical information for manufacturers exporting gas equipment to Canada' can be obtained from THE under the reference: Technical Digest No. 2024, series 1, issue 1.

Cranes for Japan

Technical Digest No. 1517, series 1, 'Digest of technical information for manufacturers exporting cranes to Japan', provides information on the specifications, codes of practice, regulations and other requirements affecting cranes exported to Japan. An appendix gives the addresses of organisations which the exporter may require to contact. Translations of the Japanese documents mentioned can be made available by THE if there is sufficient demand.

Boilers for Singapore, Malaysia and the USA

Information on the technical regulations, specifications and codes of practice affecting boilers and pressure vessels exported to Malaysia and Singapore is provided in two publications: Technical Digest No. 535, series 1, issue 1 'Digest of technical information for manufacturers exporting boilers and pressure vessels to the Republic of Singapore' and Technical Digest No. 536, series 1, issue 1 'Digest of technical information for manufacturers exporting boilers and pressure vessels to the Federation of Malaysia'.

Technical Digest No. 539, series 1, issue 1 'Digest of technical information for manufacturers exporting boilers and pressure vessels to the USA (general requirements)' covers nationwide requirements. For additional requirements relating to individual states, exporters should contact THE.

Inquiries about Technical Digests or any other service available from THE should be directed to Technical Help to Exporters, BSI, Maylands Avenue, Hemel Hempstead, Herts. Tel: Hemel Hempstead 2341.

Fire research over 25 years

THE Fire Research Station, which merged with the Building Research Station and Princes Risborough Laboratory (Timberlab) in January to form the Building Research Establishment, celebrates its 25th birthday this year with four open days to be held June 20-23, inclusive. These are the first open days to be held at FRS since 1968, and the latest developments on display will include both full-scale and model demonstrations, exhibits, slides and films. Details from Building Research Establishment, Fire Research Station, Boreham Wood, Herts WD6 2BL. Tel: 953 6177.

Electric bus project begins in Leeds

The first of two battery electric buses ordered by the Department of Trade and Industry has been delivered to Leeds City Transport. The bus is designed to carry 26 passengers and will be used initially to supplement an existing mini-bus service which passes through the pedestrian area of the city. Later it will be used on a route to link a car park with the shopping centre. Fully laden, the vehicle has a range of approximately 35 miles per battery charge in city centre traffic, rising to 70 miles when driven non stop. Top speed on level ground is about 25 miles per hour, which should be adequate for most city centre conditions.

The bus is based on conventional electric vehicle practice and standard components have been used where possible. Complete battery sets are, however, rapidly interchangeable, enabling spare, charged batteries to be used to extend the daily mileage of the vehicle.

Instruments are fitted to record engineering and operating data which will be used by manufacturers and users to assess the vehicle's characteristics. Following the experimental period at Leeds the vehicle will go to other public transport operators. It will be joined in service during the first half of 1972 by the second vehicle, now in Brussels to be exhibited at a conference on battery electric vehicles.

Inquiries regarding the loan of the vehicle for evaluation are invited from Public Service Vehicle Operators, and should be addressed to Vehicles and Mechanical Engineering Products Division, Department of Trade and Industry, Room 729, Abell House, John Islip Street, London, SW1.

More information: Where possible, items in *New Technology* indicate the best sources of further information. Readers are advised also to seek information on matters relating to *New Technology* from the following DTI regional offices: Edinburgh, 031-225 1822; Cardiff 62131; Newcastle upon Tyne 27575; Manchester, 061-832 9111; Leeds 38232; Nottingham 46121; Birmingham, 021-643 8221; Bristol 21071; London and South East, 01-684 9781; Eastern, 01-828 4355. In Northern Ireland, information is given by the Dept. of Industrial and Forensic Science, Belfast 21722.

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